SIGMA ControlNet Communication

Addendum

M/N S-3069

Version 1.0-0

Copyright: January 2001

Revision History:

Version 1.0-0 January 2001 Created by: Nick Gallo, Jeff Payne, Liam Eddy

Rockwell Automation

Bringing Together Leading Brands in Industrial Automation

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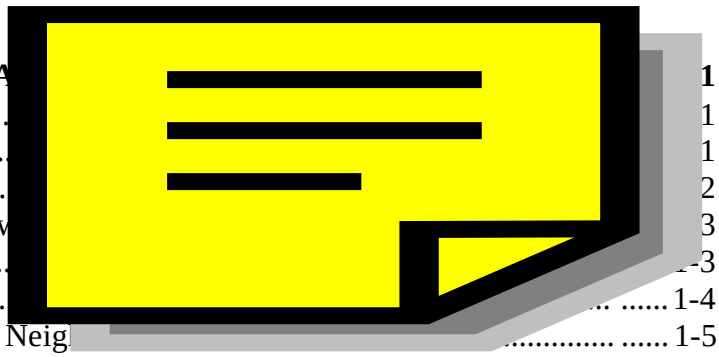

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Section 1 Introducing SIGMA-CN Communication

1.1 Section 1 Overview

This section describes the architecture of the SIGMA-CN (SIGMA on ControlNet) system. It includes basic terminology and diagrams of typical SIGMA-CN systems.

> ☝ **Note:** Use of the SIGMA-CN option requires familiarity with RSLogix 5000, AutoMax, RSNetworx, and RSLinx setup utilities and tools.
>
> This document is not intended as a user manual for any product other than SIGMA-CN.
>
> For additional user information on associated Allen Bradley and Rockwell Software products, refer to:
>
> - Multibus ControlNet Module (manual on MBCN CD), Part No. O-58820-B
> - AutoMax Programming Reference Version 4, J2-3092.
> - RSLogix (applicable manuals from the 1756 series)
> - RSNetworx manual (9357-CNETL3)
> - RSLinx manual (9399-LINXGR-JAN00)

1.2 Features

SIGMA-CN provides the following features:

- Allows SIGMA to collect data from a ControlNet network at 50ms.
- Data may be collected from AutoMax DCSNet network(s) simultaneously.
- All data from ControlNet can be used with any SIGMA facility: Trending, Alarm/Fault, Snapshot, Perm, and Drive Diagnostics (where applicable).
- SIGMA can collect data from messages originating from one or more AutoMax based O-58820-B MBCN cards.
- SIGMA can collect data from messages originating from other ControlNet devices.
- SIGMA can collect data passed through a ControlNet bridge (CNB) module.
- ControlNet tags are configured through the SIGMA Database Editor, just as any other AutoMax tag.
- Available in both Standalone and Client/Server architectures.

1.3 Terminology

Consumer – in ControlNet, a node that receives and processes data that is produced by a Producer Node.

> **Note:** A node can be both a producer and a consumer.

ControlLogix 5550 – ControlLogix 5550 Processor module, which executes user written control and automation tasks in a multitasking environment.

ControlLogix Rack – chassis into which multiple ControlLogix cards can be inserted to perform control functions or tasks. These cards include: ControlLogix 5550 processor, 1756 CNB ControlNet Bridge Module, and numerous others.

ControlNet Node Number – a unique numeric identifier assigned by the user to a device on a ControlNet network (valid ranges: 0-99). This is also known as the MAC ID.

CNB – the 1756-CNB ControlNet Bridge is the module that provides ControlNet connectivity within the ControlLogix automation controller architecture. The module resides in the ControlLogix rack.

CN-ISA Card – the SST 5136-CN-ISA card is located in the SIGMA PC and allows communication between the SIGMA PC and ControlNet. It is a full size ISA expansion card, providing dual port memory access to ControlNet—required by SIGMA-CN.

MAC ID - a unique numeric identifier assigned by the user to a device on a ControlNet network (valid ranges: 0-99). This is also known as the ControlNet Node Number.

Message – a data packet produced on the ControlNet network by a Producer Node. A message contains Tag value data and ControlNet status data. The tags whose values are contained in a message are configuredthrough tools such as RSLogix 5000 and AutoMax Programming Executive. The maximum data length of a ControlNet message is approximately 500 Bytes. This is an important value to keep in mind when setting up SIGMA-CN communications.

MBCN Card – the SST Multibus ControlNet card (Reliance Part Number O-58820-B, SST Part Number 5136-CN-MB) is located in the AutoMax Rack, and allows communication between the AutoMax and ControlNet.

Producer – in ControlNet, a node that generates data to be consumed by other nodes.

> **Note:** A node can be both a producer and a consumer.

Register – typically a physical data location in an automation controller. A register is generally 16 bits in size.

Tag – a symbolic name referring to a data location in an automation controller, such as ControlLogix or AutoMax.

SIGMA-CN – abbreviation for SIGMA ControlNet Communications Option.

UDT – User-defined Data Type, an aggregate collection of data, assembled by the user through the RSLogix 5000 development environment.

1.4 Typical SIGMA-CN Hardware

- AutoMax Resource Programmer (Required)
- ControlLogix Rack (1756-PA72)
- ControlNet 5136-CN-ISA Card (Required)
- Multibus ControlNet Module (Part No. O-58820-B)
- SIGMA PC (Required)

1.5 Software Components

- Rockwell Software RSLogix 5000, version 6.01.00 or later.
- Rockwell Software RSNetworx for ControlNet, version 2.25.12 or later.
- Rockwell Software RSLinx Gateway, version 2.20.01 or later.
- SIGMA Data Acquisition System licensed for the ControlNet Communication Option, release B2.0 or later.
- SST ControlNet Configuration Utility

1.6 Architecture

SIGMA-CN allows SIGMA to consume and produce data over a ControlNet network while simultaneously connected to AutoMax DCSNet networks. In addition to data acquisition software in the SIGMA Kernel, the SST 5136-CN-ISA card provides the SIGMA computer's physical connection to the ControlNet media.

The CN-ISA Card is a gateway to ControlNet, allowing data flow to and from other nodes on the ControlNet network. A SIGMA-CN communications system can be set up in various configurations. Figure 1-1 depicts a typical SIGMA-CN configuration, including simultaneous DCSNet communication. The Figure 1-1 configuration allows SIGMA and ControlNet devices, such as MBCN and CNB to communicate with each other over ControlNet.

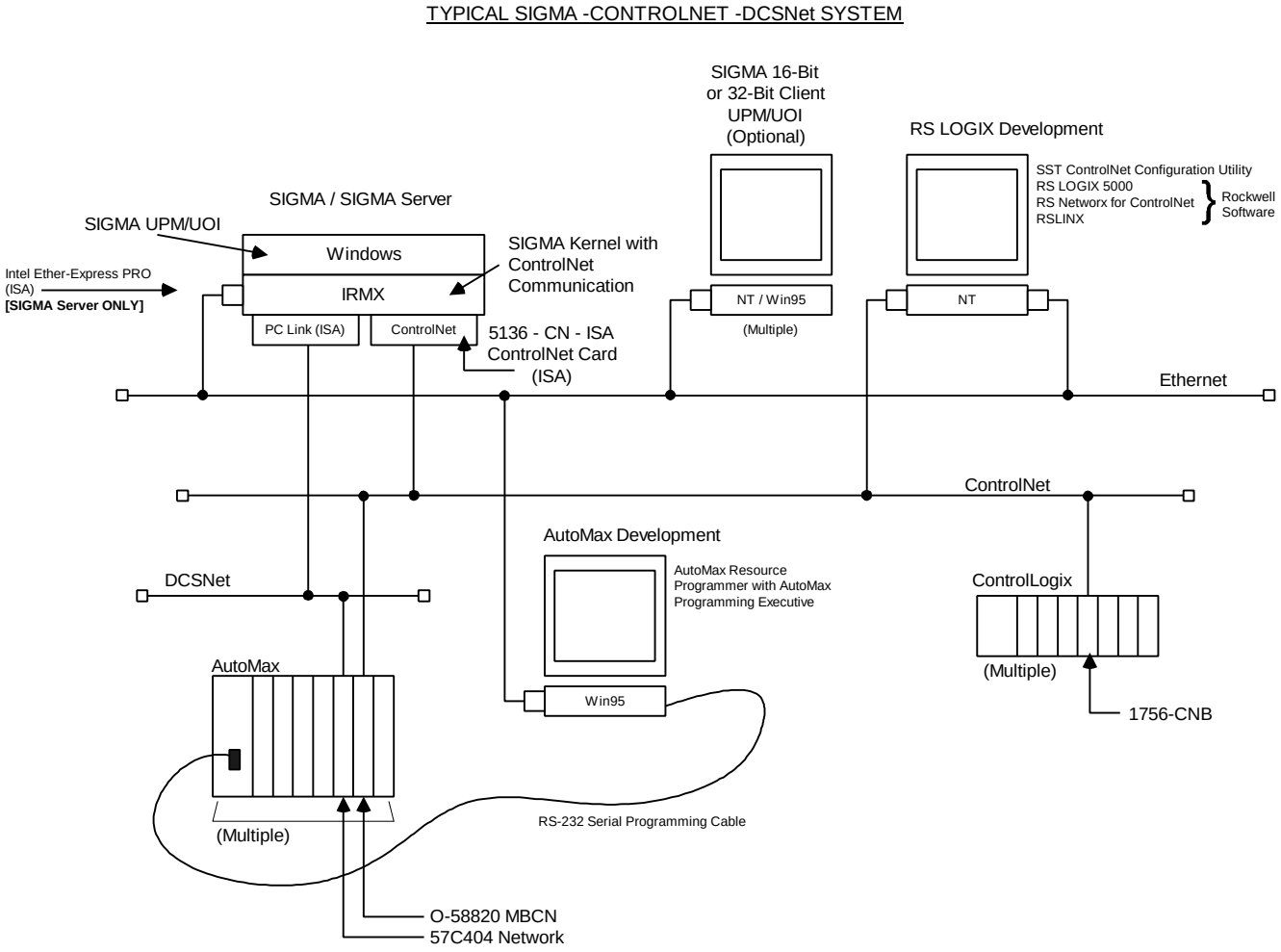

Figure 1-1 Typical SIGMA-CN Configurations

1.6.1 Typical SIGMA-CN Neighborhood

The typical SIGMA-CN neighborhood includes:

- **SIGMA / SIGMA Server** – runs the SIGMA Data Acquisition Kernel in IRMX, and uses a PC Link ISA card to read and write data over DCSNet networks, a 5136-CN-ISA ControlNet card to produce and consume data over ControlNet networks, and an INTEL Etherexpress Pro ISA card (SIGMA Server only) to communicate with SIGMA clients over an Ethernet network.
- **SIGMA Client (optional)** – runs the SIGMA Graphical User Interface under Windows NT or Windows 95 to display trend data, and faults and alarms. It connects to the SIGMA Server over the Ethernet.
- **Rockwell Software RSLogix Development machine** – runs SST ControlNet Configuration Tool, RSLogix 5000, RSNetworx for ControlNet, and RSLinx, all under Windows NT.
- **AutoMax Rack** – runs tasks, which produce and consume data over ControlNet using O-58820 MBCN cards, and read and write data over DCSNet using 57C404 Network cards.
- **AutoMax Development machine** – runs the AutoMax Programming Executive and the SLC Database Editor under Windows 95. It allows development of both the AutoMax system and SIGMA configurations. The AutoMax Programming Executive connects to the AutoMax either by direct serial connection (RS 232) or by DCSNet using a PC Link card.
- **ControlLogix Rack** – (multiple) Controller running tasks, producing and consuming data on ControlNet through a CNB Module.
- **Ethernet** – provides Peer-to-Peer computer communication.
- **ControlNet** – high speed, deterministic, control data network for automation device communication.
- **DCSNet** – high speed, deterministic, control data network for AutoMax communication.

Section 2 Laying the Groundwork for SIGMA-CN

2.1 Section 2 Overview

Section 2 discusses preparations, hardware, and software requirements for setting up the SIGMA-CN communication system. These instructions assume that you have access to all the necessary hardware and software documentation for all collateral parts of your system.

2.1.1 The Key To Setting Up SIGMA-CN Communications

There are several independent software configuration tools required to properly set up all of the necessary ControlNet, ControlLogix, AutoMax, and SIGMA parameters to establish SIGMA-CN Communication. You must ensure that the information specified in each of these independent tools, such as ControlNet node numbers, message lengths, register offsets, and so on, is consistent and accurate.

- **AutoMax layout** – using AutoMax Program Executive, you must define tags and registers on MBCN per ControlNet Message information produced external to AutoMax Program Executive. Take the register map provided by the SST utility and define tags on the 32K I/O card.
- **AutoMax MBCN ControlNet Configuration** – using the SST ControlNet Configuration Utility layout, you must define ControlNet Device, MAC ID, and messaging layout for the MBCN card to produce and consume ControlNet data.
- **CN-ISA card** – using the SST ControlNet Configuration Utility, you must define ControlNet Device, MAC ID, and messaging layout for the CN-ISA card to produce and consume ControlNet data.
- **ControlLogix layout** – using RSLogix 5000, you must define data structures and tags to properly produce and consume ControlNet data with SIGMA.
- **SIGMA configuration** – using the SIGMA SLC Database Editor, you must define ControlNet messaging parameters for SIGMA to get ControlNet data to the correct tags.
- **ControlNet scheduling** – using RSNetworx, you must duplicate and define the SIGMA and MBCN configurations for other ControlNet devices.

Some Rules:

- Data is produced on ControlNet in packets called "messages."
- Each message can be up to 250 registers in length; you must enforce this.
- ControlLogix tag names representing SIGMA messages must be unique system wide.

2.2 Setting up the SIGMA / SIGMA Server

The SIGMA / SIGMA Server and SIGMA Client are two separate machines (Figure 1-1). Each has specific hardware and software requirements.

1. Set the switches and jumper on the SST card. (Refer to section *2.3 Hardware Installation*, in the *SST 5136-CN User's Guide, Version 1.00*.)
2. Install PC Link card per instructions in section 2.6 of the Developer's portion of the SIGMA Universal Operator Interface / Universal Process Monitor User's Manual. (An electronic copy is available on the SIGMA Installation CD.)
3. Install the CN-ISA Card in the SIGMA computer. (Refer to section *2.3.3 Installing the Card*, in the *SST 5136-CN User's Guide, Version 1.00*.)
4. After installing the 5136-CN-ISA card, run the setup file C:\SIGMA\CNET\ID_KTCS.BAT. This changes the card's identity to "1754-KTCS." This only needs to be run once.

   There is no need to install the drivers. The SIGMA Installation CD installs these.
5. Install DOS/Windows per instructions in the MS-DOS Users Guide and in the Microsoft Windows User Guide. (Installation Kits are provided on the SIGMA Installation CD).
6. Install SIGMA software and iRMX, using the SIGMA Installation CD, and appropriate SIGMA license floppy disk (Version B20 or later of SIGMA Installation CD)

CAUTION	**The ControlNet Communication Option is set up with the license disk used to install SIGMA. CONFIG.SYS and all necessary installation/setup drivers for SIGMA are installed.** **Installation information must match the information in the license file. You should verify that the parameters for the CN-ISA card in the installed CCONFIG.SYS match the jumper settings on the card.**

2.3 Connecting the CN-ISA Card to a ControlNet Network

Connect the card to the ControlNet network trunkline like any other ControlNet node. (Refer to section *2.6 Connecting to a ControlNet Network*, in the *SST 5136-CN User's Guide, Version 1.0.0* for detailed instructions.)

2.4 Setting up the SIGMA Client

- Install Windows NT or Windows 95 per instructions in the appropriate Microsoft Installation Documentation.
- Install SIGMA 16-bit (Windows 95) or 32-bit (Windows NT) client per instructions in Chapter 2 of the Developer's portion of the SIGMA Universal Operator Interface / Universal Process Monitor User's Manual. (An electronic copy is available on the SIGMA Installation CD.)

2.5 Setting Up Control System Development Machines

Two different development machines are used to setup and define the control system for SIGMA-CN communications, the AutoMax Development machine (running on Windows 95) sets up and defines the AutoMax and SIGMA side of the system, and the RSLogix Development machine (running on Windows NT) defines the ControlLogix and ControlNet side of the system (Figure 1-1).

2.5.1 AutoMax Development Machine

The AutoMax Resource Programmer and SIGMA Development Machine should be set up. A typical AutoMax developer environment requires at least the following (see AutoMax Programming Reference Version 4, J2-3092 and Multibus ControlNet Module manual, Part No. O-58820-B — on MBCN CD):

- Install Windows 95
- Install AutoMax Programming Executive (version 3.7, or later)
- Install SLC Database Editor from the SIGMA Installation CD according to the instructions in section 2.9 of the SIGMA Universal Operator Interface / Universal Process Monitor, M/N D2-3289. No license Disk is required to install this utility.

2.5.2 RSLogix 5000 Programmer (RSLogix Development machine)

The RSLogix5000 Programmer should be set up for both typical ControlLogix development environment and the typical SST ControlNet configuration environment. You need to install at least the following:

- Install Windows NT Workstation 4.0
- Install RSLinx
- Install RSLogix5000
- Install RSNetworx for ControlNet
- Install SST ControlNet Configuration Utility

Section 3 Setting Up SIGMA-CN Communication

This section describes two SIGMA-CN Communication scenarios, with typical setup directions for each scenario.

- Using SIGMA-CN Communication with ControlLogix
- Using SIGMA-CN Communication with the MBCN

3.1 Scenario 1: Using SIGMA Communication with ControlLogix

Scenario 1 uses the following software tools to setup SIGMA-CN communications.

- **RSLogix 5000** – sets up the ControlLogix side of communication.
- **SST ControlNet Configuration Utility** – sets up the ControlNet network node configuration for the CN-ISA card.
- **AutoMax Programming Executive** – sets up the SIGMA side source tag configuration.
- **SLC Database Editor** – sets up the standard SIGMA tag configuration and the SIGMA side ControlNet messaging configuration.
- **RSNetworx** – sets up scheduling for the ControlNet messages specified through RSLogix 5000.

3.1.1 Scenario 1: RSLogix 5000 Tasks

Use RSLogix 5000 to setup the ControlLogix rack's ControlNet communication messaging and tag information for producing and consuming data with SIGMA.

SCENARIO 1, RSLOGIX STEP 1:

In the ***I/O Configuration*** section, define a node for the CNB module that the ControlLogix rack will use to communicate with SIGMA (Figure 3-1).

Under the CNB module, define a node representing SIGMA. This must be defined as a 1785 PLC5C.

In the ***Module Properties*** page of this node, specify the ControlNet ***Node*** number (MAC ID) of the SIGMA CN-ISA card. This is assigned either in RSNetworx (Version 3.00.00.12, or later) or in the SST ControlNet Configuration Utility. Remember this value, you need to use this for the SLC Database Editor ***Port Configuration Drop Number*** parameter value for the card.

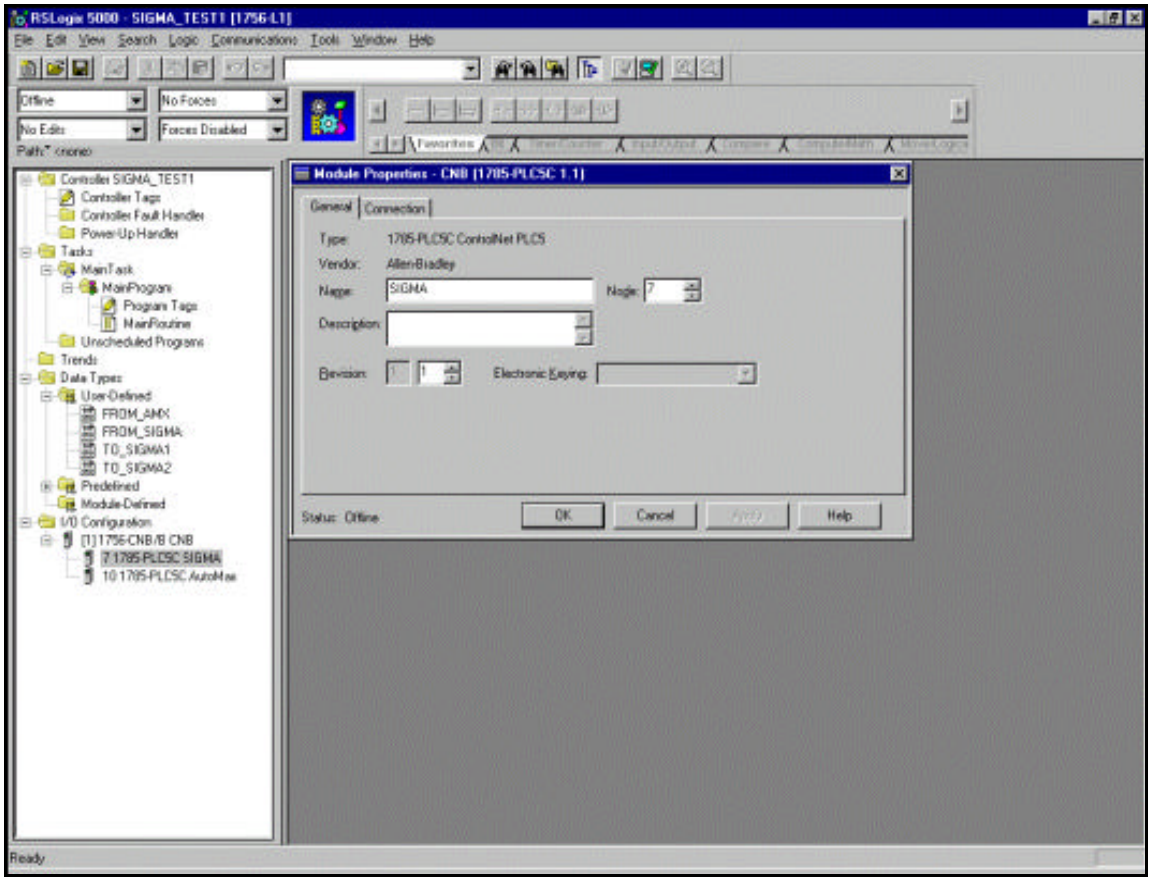

Figure 3-1 Setting up a SIGMA Node for ControlLogix communication with SIGMA

SCENARIO 1, RSLOGIX STEP 2:

To represent the set of data produced or consumed by SIGMA, define one or more UDTs (User Defined Type) under the ***User-Defined*** folder, under the ***Data Types*** folder. Each UDT should contain an n-element array of INTs or DINTs. (Figure 3-2).

> **Note:** Each UDT represents the data in one ControlNet message, whether produced or consumed. Since a ControlNet message cannot exceed 500 bytes, neither can your UDT representing the message. Therefore, maximum array size of an INT array is 250 elements, and 125 elements for a DINT array.

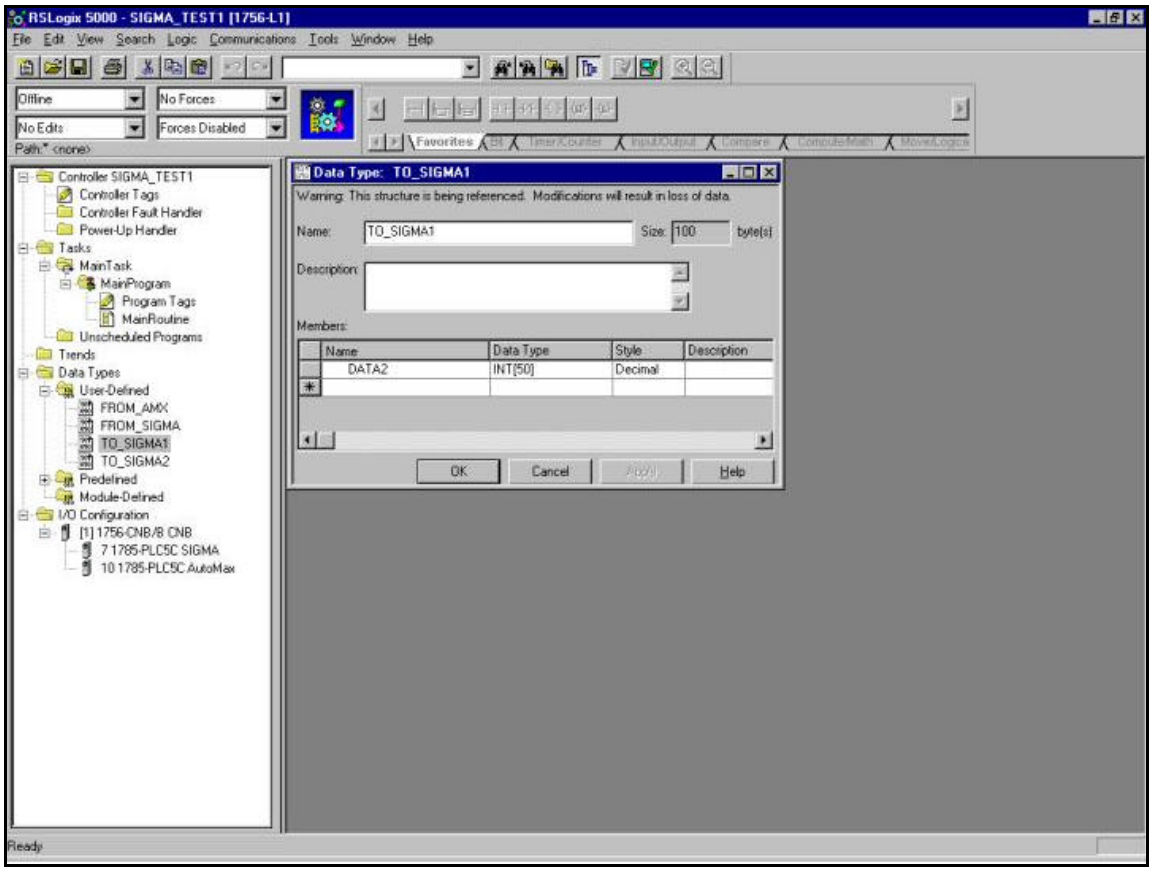

Figure 3-2 Defining a UDT for data consumed by SIGMA

SCENARIO 1, RSLOGIX STEP 3:

Under the ***Controller Tags*** folder, highlight the ***Controller Tags*** item and display its property sheet. Select the ***Edit Tags*** tab.

Define ***Tag Names*** using the UDTs defined earlier. Remember the Controller ***Tag Names*** you assign here. You must use these in the SLC Database Editor as the ***MSGNUM*** parameter value in the ***Port Configuration Description field.***

> **Note:** For multiple ControlLogix racks producing data for SIGMA, each ***Controller*** tag name must be unique across the system. For example, if you wanted each controller to produce a tag called SI1 [(S)end (I)ntegers (1)]. Then you need to extend each tag name so that it is unique amongst all controllers, such as SI1_C1 for the first controller, and SI1_C2 for the second controller.

For Tags being produced by ControlLogix for SIGMA, make sure the ***"P"*** (Producer) column is checked (Figure 3-3).

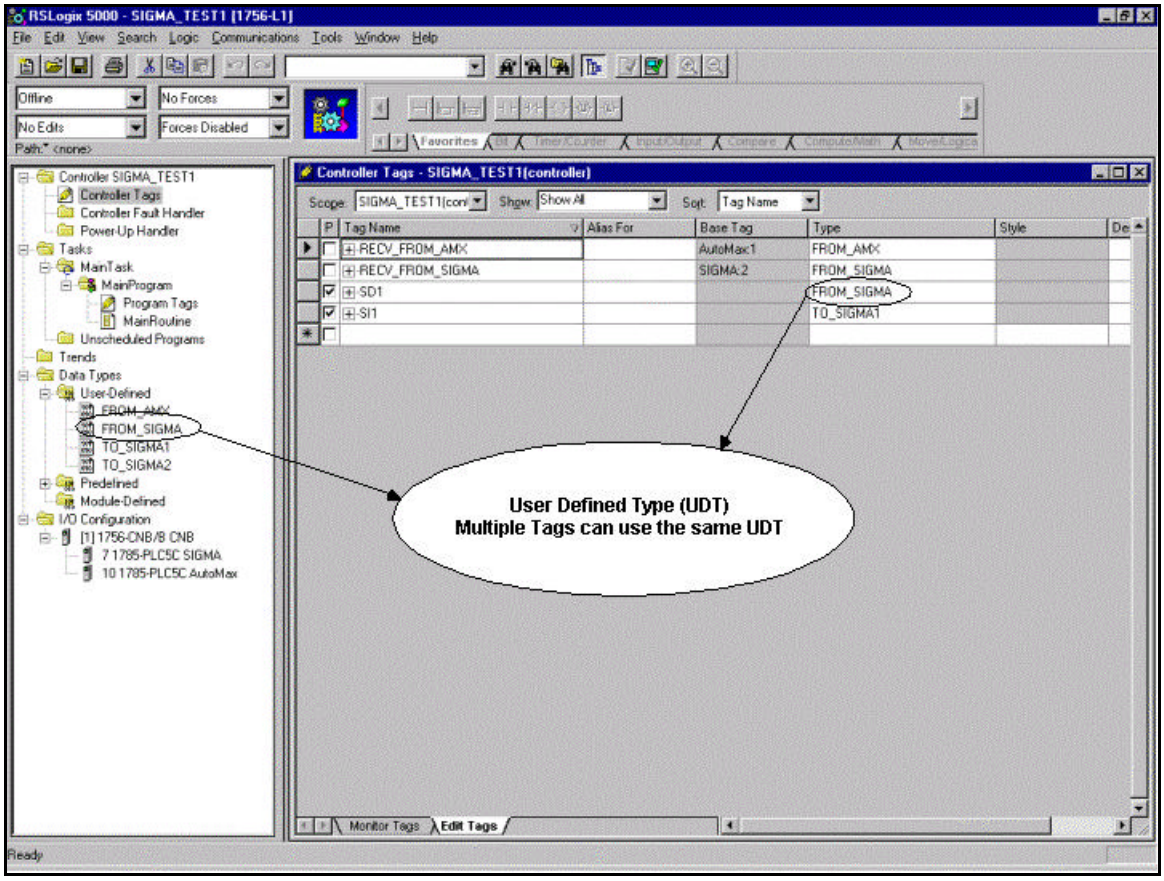

Figure 3-3 Defining Tags using UDTs for data produced and consumed by ControlLogix with SIGMA

SCENARIO 1, RSLOGIX STEP 4:

For Controller Tags being produced by SIGMA and consumed by ControlLogix, display the ***Tag Properties*** page and set the ***Remote Instance*** property to the message number used by SIGMA for the message (generated either by RSNetworx, Version 3.0, or in the SST Configuration Utility). Make sure that the ***Consumed*** radio button is selected, and make sure that the appropriate controller is selected in the ***Controller*** pulldown list. You can also set the RPI for ControlLogix to consume the data (Figure 3-4).

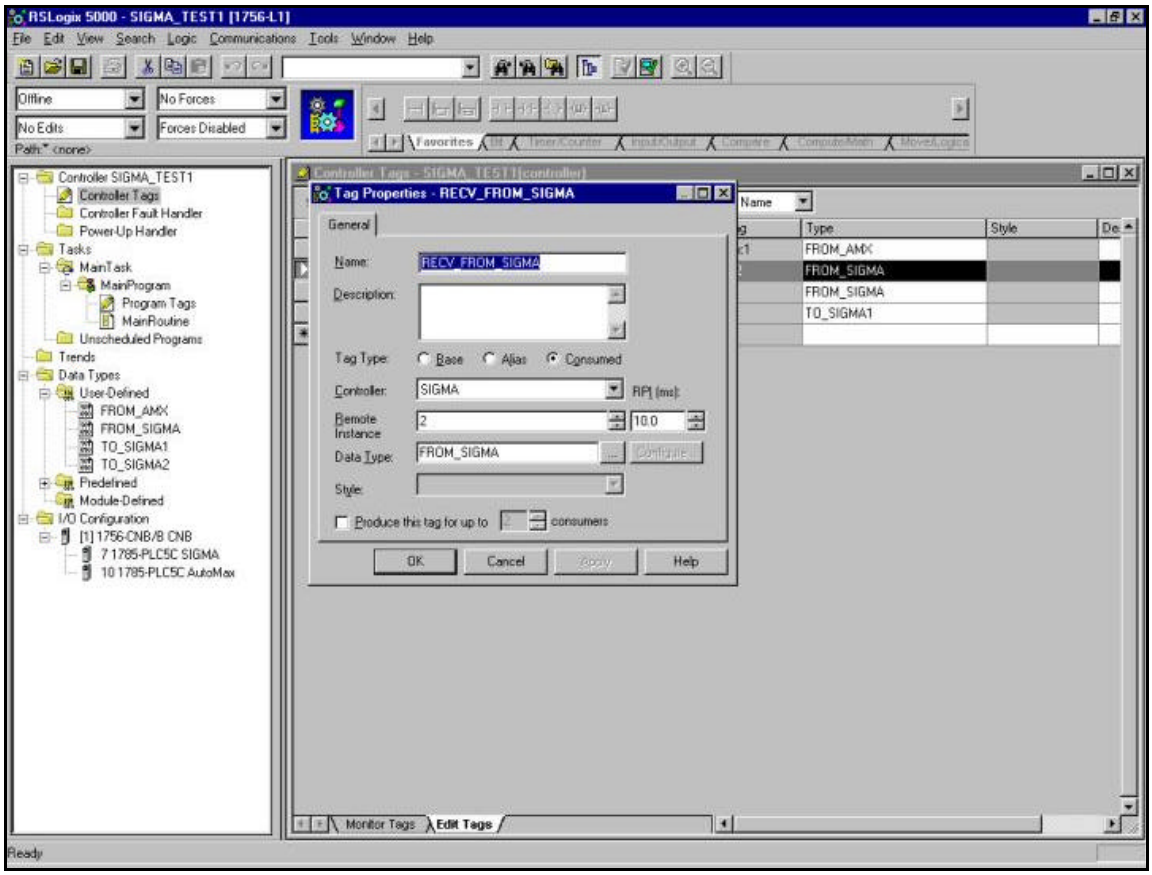

Figure 3-4 Setting Tag Properties for Messages Produced by SIGMA

SCENARIO 1, RSLOGIX STEP 5:

Create appropriate ControlLogix code to manage produced and consumed data for SIGMA. This is done by creating tasks under the ***Tasks*** folder (Figure 3-5).

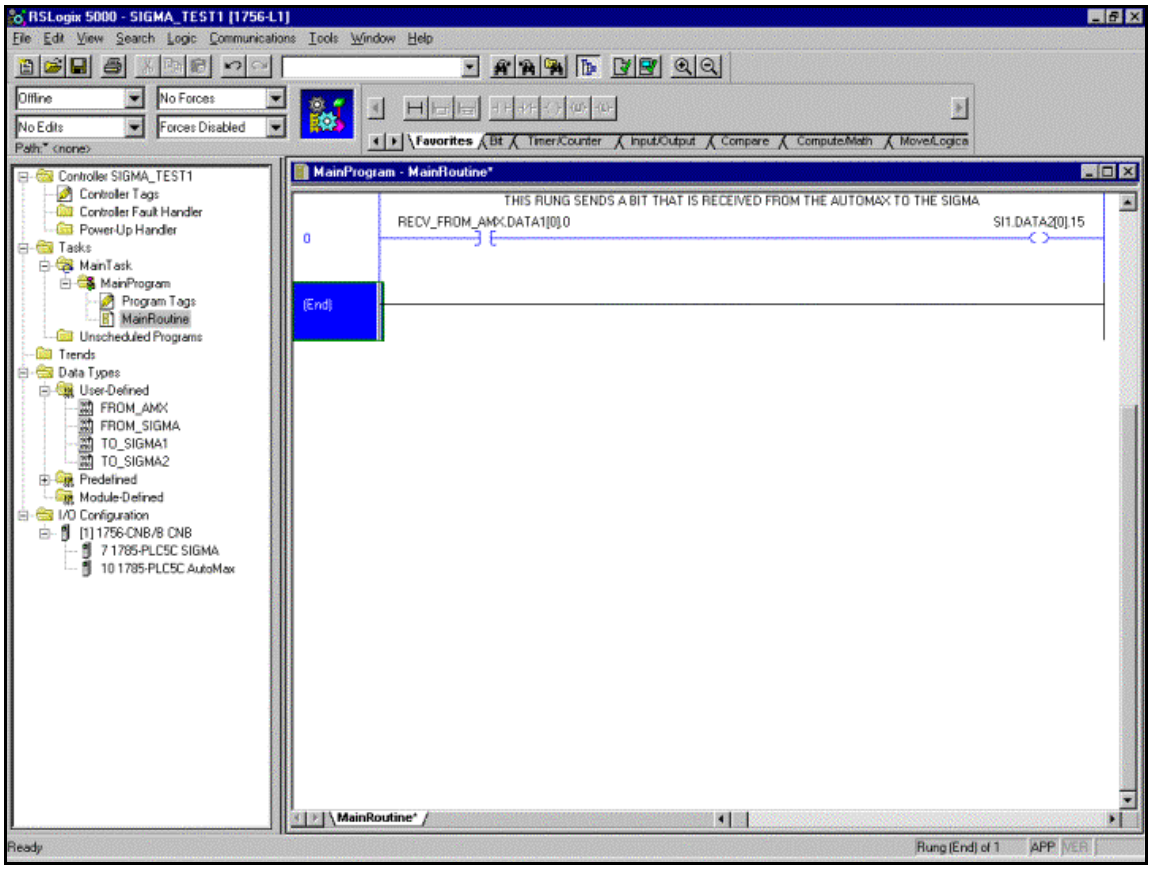

Figure 3-5 A ControlLogix ladder rung generating a data element to be consumed by SIGMA

3.1.2 Scenario 1, SST ControlNet Configuration Utility Tasks

Use the SST ControlNet Configuration Utility to create a representation of the ControlNet network from SIGMA's point of view. Only the nodes that SIGMA communicates with must be defined.

> **Note:** You can use Version 3.00.00.12 (or later) of RSNetworx to perform these same functions.

SCENARIO 1, SST CONTROLNET CONFIGURATION UTILITY, STEP 1:

Define a node representing the SIGMA's CN-ISA card and set its MAC ID (the ControlNet node number) in the ***Scanner Properties*** page's ***Scanner*** tab. You define this value. Remember this value since you will need to use it in RSLogix 5000 as the value for the ***Node*** parameter in the ***Module Properties*** page's ***General*** tab for the I/O Configuration node defined to represent SIGMA.

Under the SIGMA node, define a ControlLogix node for each ControlLogix message SIGMA wants to consume. Remember that each message on the ControlLogix side is represented by a unique ControlLogix tag name, defined in RSLogix 5000, and must be 500 bytes or less in length.

Under each ControlLogix node, define a node representing the CNB module generating the message SIGMA wants to consume. Set the CNB's MAC ID in the ***SST ControlNet Node Properties*** page's ***General*** tab. This value is defined in RSLogix 5000.

> **Note:** You cannot define multiple CNB nodes (i.e., messages) under a single ControlLogix node in this utility even if the actual CNB is generating multiple messages. For each message, you must define multiple ControlLogix nodes, with each node containing a CNB module node to define the parameters of that message.

Set the ControlLogix tag name for the data (from RSLogix 5000) using the ControlLogix ***Tags*** push button on the ***General*** tab of the ***SST ControlNet Node Properties*** page.

If SIGMA is producing data, define an ***SST-CN-ISA*** node under SIGMA's main node. Use the ***SST ControlNet Node Properties*** sheet to describe the data SIGMA is to produce, and set the ControlNet message number (called the Producer Buffer Id) for the produced data. Remember this value since you must use it as the ***Remote Instance*** value in RSLogix 5000 when you define the ***Tag Properties*** for the ControlLogix tag consuming this data.

> **Note:** Remember that the maximum length of a message is 500 bytes.

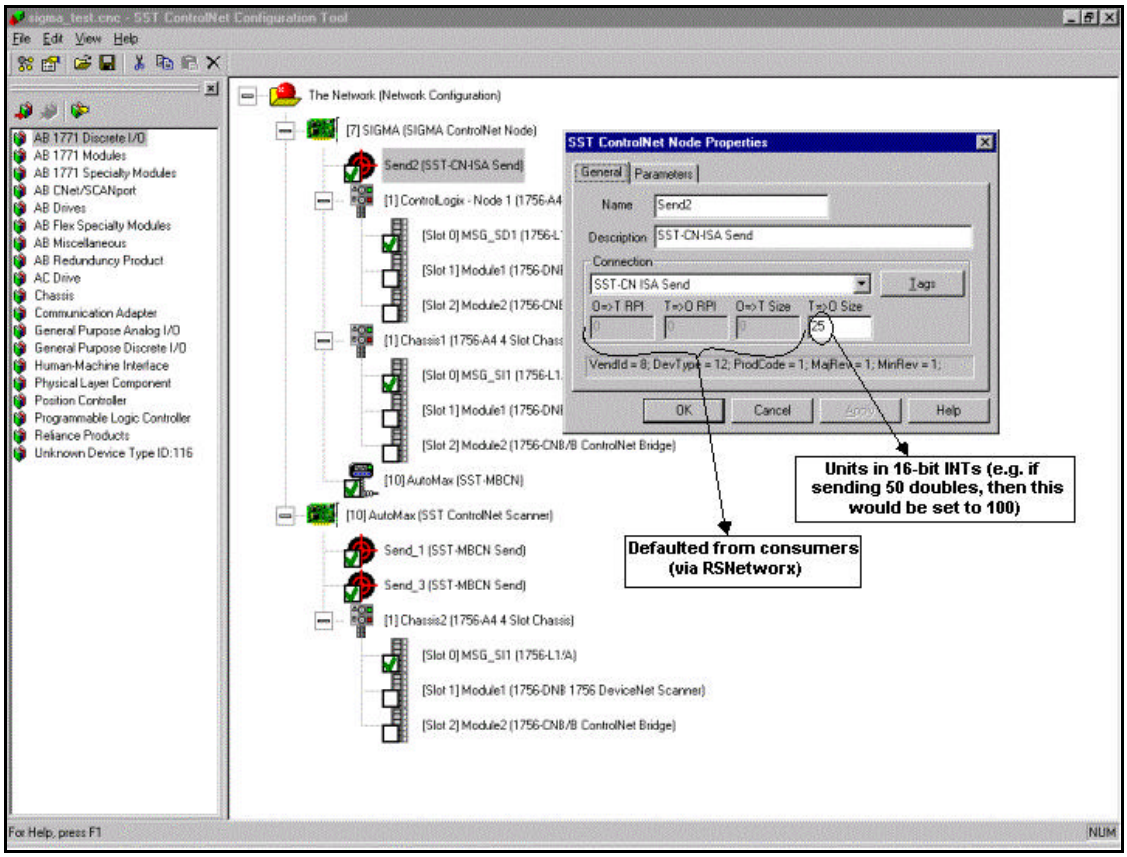

Figure 3-6 Setting up ControlNet Node Properties with the SST Configuration Utility

SCENARIO 1, SST CONTROLNET CONFIGURATION UTILITY, STEP 2:

After defining all nodes/messages you can view the CNISA register assignments for the various messages through the ***SST ControlNet Scanner Properties*** page's ***Connections*** tab. Remember these values since you must use them to set the value of the***START*** parameter in the SLC Database Editor's ***Port Configuration Information Description*** field for each message.

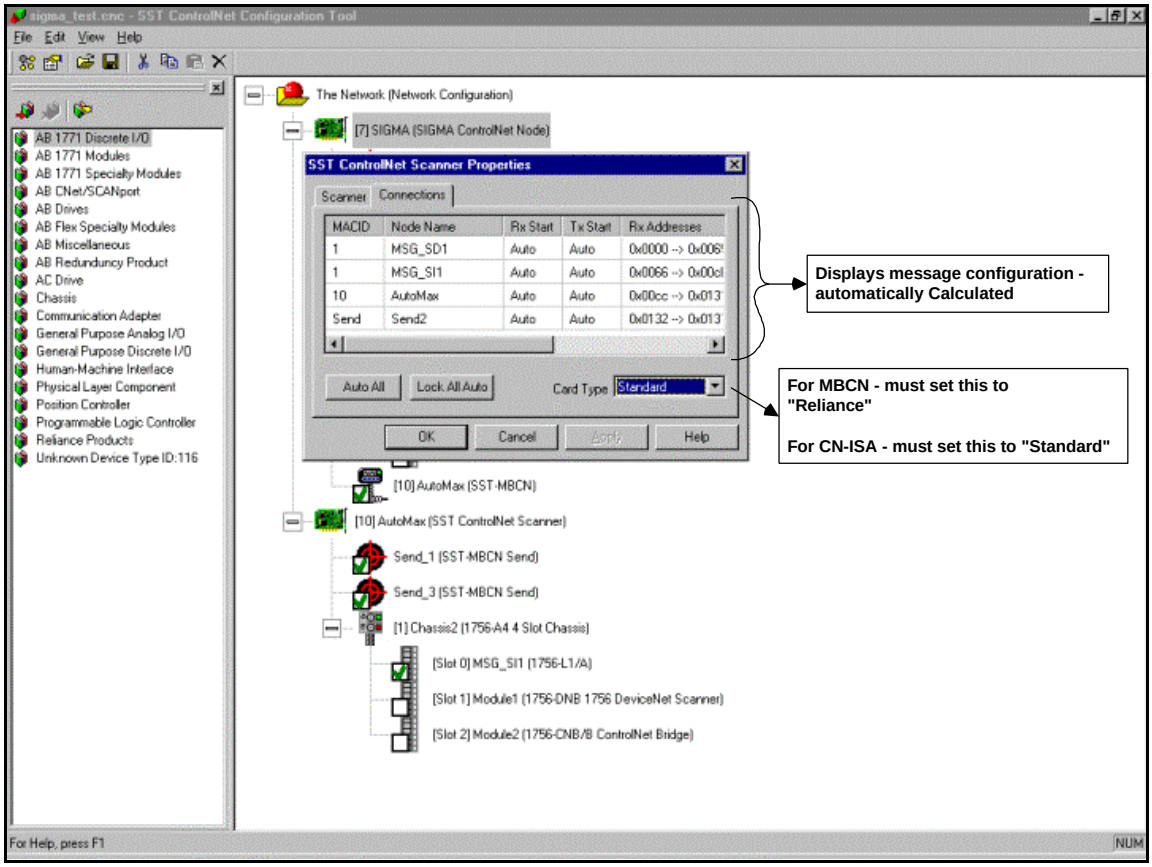

Figure 3-7 Setting the Card Type in the ControlNet Scanner Properties Page

Generate the configuration output file or otherwise download the configuration to the SIGMA CN-ISA card over ControlNet.

3.1.3 Scenario 1, AutoMax Programming Executive Tasks

Even though SIGMA is not communicating with any AutoMax controllers in this scenario, you need to use the AutoMax Programming Executive to define tag locations in the ControlNet messages SIGMA is to produce or consume.

SCENARIO 1, AUTOMAX PROGRAMMING EXECUTIVE, STEP 1:

The tags associated with ControlNet are defined on a generic 32K I/O card (GEN 32K).

For each different ControlNet node that SIGMA will communicate with, you must define a separate AutoMax rack and single 32K I/O card.

> **Note:** This is a configuration construction only, and does not have any impact on the physical architecture of the system.
>
> For example, if SIGMA is to communicate with two CNB cards in the same ControlLogix rack, you must define two separate AutoMax racks, each with one 32K I/O card, to represent the two CNB cards.

When you define a rack in the Programming Executive, you assign it a rack name. Remember this name since you must use it as the value of the ***RACK*** parameter in the SLC Database Editor's ***Port Configuration Information Description*** field. The rack name you assign should be as short as possible (e.g., "CN1"). This ensures that the ***Description*** field value will be able to hold all of the necessary messaging description.

Assign tags to registers on the 32K I/O in the order in which they are produced or consumed by the ControlNet nodes. The tags appearing in the lower numbered registers are the first to appear in the ControlNet message. All tags associated with a message must be contiguous.

Message tags can begin at any address on the card. You will need to remember each ***Start Register*** address to use as the value of the ***START*** parameter in the SLC Database Editor's ***Port Configuration Information Description*** field.

> **Note:** As you assign tags to registers, you must account for status registers provided in ControlNet messaging. Refer to section 3.3 for more information.

3.1.4 Scenario 1, SLC Database Editor Tasks

Use the SLC Database Editor to define the tag and ControlNet messaging configuration for SIGMA.

SCENARIO 1, SLC DATABASE EDITOR, STEP 1:

In the SLC Database Editor, after creating an SLC Database for the order, go to the ***Add Racks*** screen and include the racks you defined containing the ControlNet tags that SIGMA is to monitor.

Add the tags to be monitored through the ***Add Variables*** screen. Set scaling, alarm/fault configuration, and trending configuration through the ***Variable Objects*** screen.

Go to the ***Port Configuration*** screen to define the communication parameters for the ControlNet messages produced or consumed for the defined tags.

> ☝ **Note:** For ControlNet, one port configuration record is required for each ControlNet message being produced or consumed by SIGMA. Each record must describe parameters about its ControlNet message through the ***Description*** field. The field must be structured as described in section *4.2 Using the Port Configuration Screen to Define Messages*, or else SIGMA will not be able to interpret the ControlNet message.

For communication with ControlLogix, use the ControlLogix tag name as the value of the ***MSGNUM*** parameter in the ***Port Configuration Information Description*** field.

For each port configuration entry that represents the first message from the CN-ISA card, you must set the ***Port Number*** field value to that of the dipswitch settings on the card (e.g. 250, 258, 260). Otherwise, this field should be blank.

For the port configuration entries representing the other messages from the node, you must set this field to **0**.

After finishing the SLC Database configuration, make sure the new database is in the proper SIGMA directory and reboot SIGMA.

3.2 Scenario 2: Using SIGMA-CN Communication with the MBCN

A lot of information necessary for this communication scenario has been covered in the description of the previous scenario (*3.1 Scenario 1: Using SIGMA Communication with ControlLogix*). It is helpful to review that section before starting this section.

Scenario 2 uses the following software tools to setup SIGMA-CN communications.

- **SST ControlNet Configuration Utility** – (RSNetworx) sets up the ControlNet network node configuration for the MBCN and SIGMA CN-ISA card.
- **AutoMax Programming Executive** – assigns AutoMax tags to the MBCN card and creates AutoMax code to read and write tag values.
- **SLC Database Editor** – sets up the standard SIGMA tag configuration and the SIGMA side ControlNet messaging configuration.
- **RSNetworx** – generates and downloads ControlNet schedule to nodes.

Note that the MBCN allocates specific sets of registers for specific purposes. For example:

- Registers 16384-24575 – Scheduled consumed data registers (AutoMax is a "consumer")
- Registers 24576-32767 – Scheduled produced data registers (AutoMax is a "producer")
- Additional register sets are defined, and can be found in the MBCN manual. (Refer to the Multibus ControlNet Module – manual on MBCN CD – Part No. O-58820-B for more information on MBCN setup and register mapping.)

3.2.1 Scenario 2, SST ControlNet Configuration Utility Tasks

Use this utility to create a representation of the ControlNet network from SIGMA's point of view. Only the nodes that SIGMA communicates with must be defined.

SCENARIO 2, SST CONTROLNET CONFIGURATION UTILITY, STEP 1:

Setup the producer side of the communication first by defining a node representing the MBCN, and set its MAC ID (ControlNet node number) through the ***Scanner Properties*** page's ***Scanner*** tab. This value must match the thumbwheel setting on the actual MBCN card. In the ***Connections*** tab you must set the ***Card Type*** field to ***Reliance*** (Figure 3-7).

For each message the MBCN produces, define an SST-MBCN node under the MBCN node.

Use the ***Node Properties*** page's ***General*** tab to setup message parameters, including message size (Figure 3-6). Use the ***Parameters*** tab to set the ControlNet message number (***Produce Buffer ID***) for the message. It must be unique across the system.

After setting up all messages, use the ***Scanner Properties*** page's ***Connection*** tab to look at the MBCN register assignments. Remember these values since you must use them to properly layout tags in the AutoMax Programming Executive in order to populate the messages (Figure 4-1).

SCENARIO 2, SST CONTROLNET CONFIGURATION UTILITY, STEP 2:

Setup the consumer side next. Define a node representing the SIGMA's CN-ISA card and set its MAC ID similar to the previous scenario (refer to section 3.1.2).

Under the SIGMA node, define an MBCN node for each MBCN message that SIGMA will consume. Each message on the MBCN side is represented by a unique number (known as the ***Produce Buffer ID***), which is assigned in this utility when setting up MBCN communication.

> ☝ **Note:** You cannot define multiple messages using a single MBCN node in this utility even if the actual MBCN is generating multiple messages.
>
> You must configure the messaging as described above!

Set the MBCN ControlNet parameters using the ***Node Properties*** page's ***General*** tab. Use this to set the MAC ID of the MBCN. This must match the MAC ID actually assigned to the MBCN node defined on the producer side of the communication. You must also set the size of the message being received. Again, this must match the setup of the producer side of the communication. You must ensure that all of these values match up with the producer side of the communication.

In the ***Node Properties*** page's ***General*** tab, set the ControlNet message number (***Consume Buffer ID***) parameter for the consumed data. This value must match the value of the ***Produce Buffer ID*** parameter defined in the producer side of the communication. You must ensure that these values match.

If SIGMA is producing data for the MBCN, it is setup as in section *3.1.2 Scenario 1, SST ControlNet Configuration Utility Tasks.*

SCENARIO 2, SST CONTROLNET CONFIGURATION UTILITY, STEP 3:

After defining all nodes/messages you can view the register assignments for the various messages through the ***Scanner Properties*** page's ***Connections*** tab. Remember these values since you must use them to set the value of the ***START*** parameter in the SLC Database Editor's ***Port Configuration Description*** field for each message.

SCENARIO 2, SST CONTROLNET CONFIGURATION UTILITY, STEP 4:

Generate the configuration output file or otherwise download the configuration to the SIGMA CN-ISA card over ControlNet.

Run RSNetworx and download its scheduling configuration to the nodes on the ControlNet.

3.2.2 Scenario 2, AutoMax Programming Executive Tasks

Use the AutoMax Programming Executive to assign tags to registers on the MBCN and to create tasks that read and write those tag values.

SCENARIO 2, AUTOMAX PROGRAMMING EXECUTIVE, STEP 1:

The MBCN is represented in the AutoMax Programming Executive with a generic 32K I/O card (GEN 32K).

Each different MBCN card the SIGMA will communicate with requires defining its own AutoMax rack and single 32K I/O card.

> **Note:** This is a configuration construction only, and does not have any impact on the physical architecture of the system.
>
> For example, if SIGMA is to communicate with two MBCN cards in the same AutoMax rack, you must define two separate AutoMax racks, each with one 32K I/O card, to represent the two MBCNs.

The assignment of tags is similar to the previous scenario. The only caution is that tags must be assigned to certain register ranges on the card. This information is determined externally. If you are using the SST ControlNet Configuration Utility, it will provide these register ranges for you. Refer to the previous section for more information, and appropriate SST documentation (refer to section 3.1.3).

> **Note:** As you assign tags to registers, you must account for status registers provided in ControlNet messaging. Refer to section 3.3 for more information.

SCENARIO 2, AUTOMAX PROGRAMMING EXECUTIVE, STEP 2:

Write tasks to read and write the tags defined on the MBCN card. These can be U. C. Basic, ladder, or block tasks.

SCENARIO 2, AUTOMAX PROGRAMMING EXECUTIVE, STEP 3:

After the configuration is complete, download the tasks and configuration modules to the AutoMax controller(s) either serially or using DCSNET through a PC Link card.

3.2.3 Scenario 2, SLC Database Editor Tasks

Use the SLC Database Editor to define the tag and ControlNet messaging configuration for SIGMA.

SCENARIO 2, SLC DATABASE EDITOR, STEP 1:

The setup of the SLC SIGMA database is similar to section *3.1.4 Scenario 1, SLC Database Editor Tasks*.

For communication with MBCN, use the message number (set as Produce or Consume Buffer Id in the SST ControlNet Configuration Utility) as the value of the ***MSGNUM*** parameter in the ***Port Configuration Description*** field (see section *4.2.2 Using the Description Field* for more details).

3.3 Accounting for ControlNet Status Registers

When any device sends data on ControlNet it also provides a set of status registers at the beginning of the message. Each type of device provides a different number of status registers. For example, a ControlLogix rack or PLC rack provides one status register; a GV3000 or FlexPak3000 provides five status registers. Refer to appropriate device documentation to determine the number of status registers provided by the device.

Effectively, this divides the contents of a ControlNet message into a set of status registers and a set of data registers. The CN-ISA card publishes both sets of registers, although only the data registers can be read/written by SIGMA. Therefore, it is necessary to account for these status registers when laying out the data registers on the generic 32K I/O card in the AutoMax configuration, so that the data is mapped to the correct tags. For example, if the MBCN card is receiving a message from a ControlLogix rack starting at register 16800 on the card, then the first tag in the message is assigned to register 16801, not 16800 (Figure 3-8 indicates this).

> **Note:** This must be taken into account whether or not SIGMA is communicating with an MBCN card.

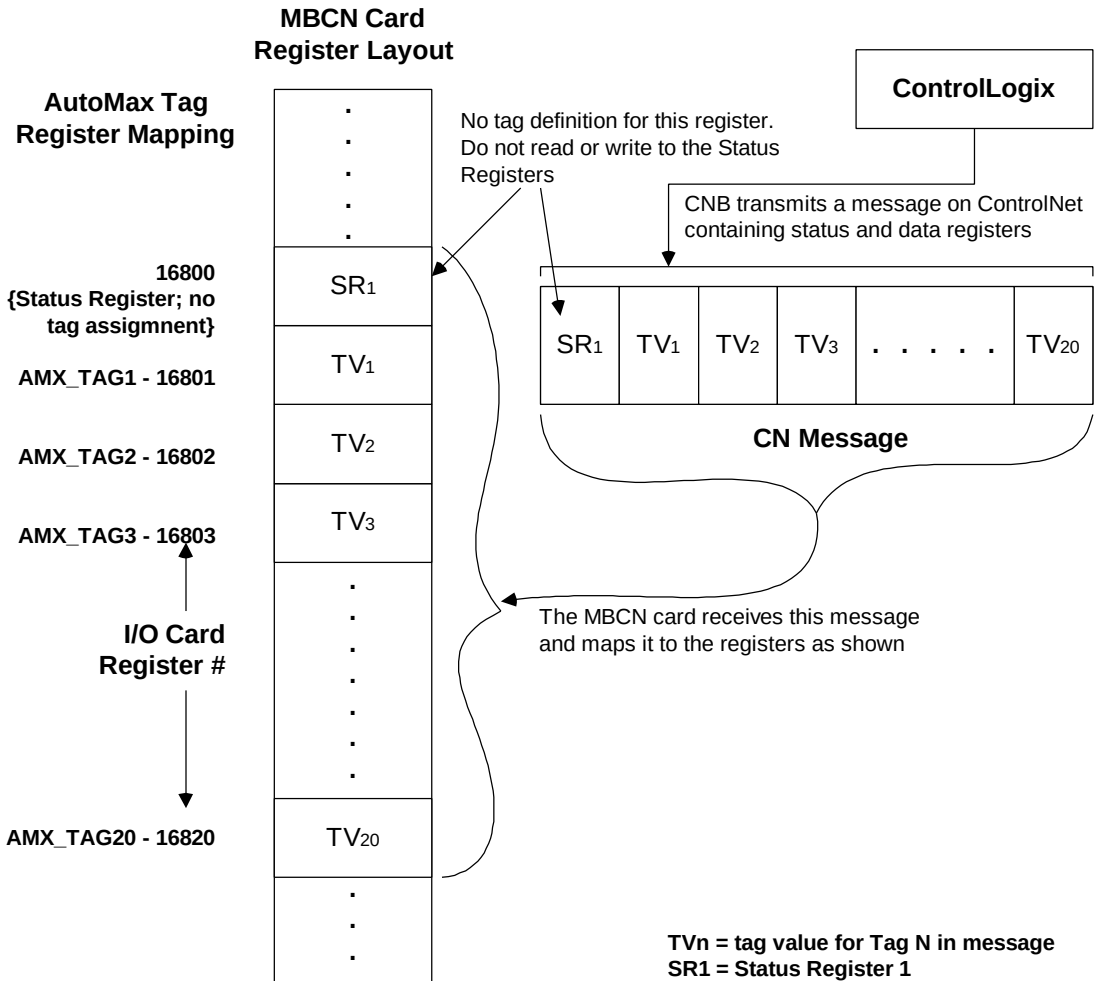

Figure 3-8 ControlNet Status and Data Register Mapping on the MBCN Card

Section 4 SLC Database Configuration

4.1 Overview

This section describes the requirements for telling SIGMA about the transmission of tag data (i.e., the tag configuration) on ControlNet. As with previous versions, SIGMA requires all tag configuration information to be specified through an AutoMax configuration database, generated by the AutoMax Programming Executive. This configuration database is used by the SIGMA SLC Database Editor to create the SIGMA SLC Database, which is then loaded when SIGMA is started up.

It is possible with SIGMA-CN to collect data from MBCN cards residing on the ControlNet, or from other, non-MBCN devices on the ControlNet. In other words, SIGMA is not required to communicate only with an MBCN card.

However, in either case, it is necessary to provide an appropriate AutoMax configuration database to tell SIGMA about the ControlNet tag configuration (how it receives the data from ControlNet).

After using the SLC Database Editor to include and configure all of the racks and tags that SIGMA is going to monitor, you must define all of the ControlNet communication parameters necessary for SIGMA to determine how to produce or consume tag data on ControlNet. This section describes how to setup this information in the SLC Database Editor. The goal of this configuration is to:

- Tell SIGMA about all of the ControlNet messages that SIGMA must produce or consume.
- Tell SIGMA which rack defined through the AutoMax Programming Executive provides data for which message. Remember that a rack corresponds to a node on the ControlNet, be it a MBCN card or ControlLogix rack's CNB module. Remember that each node must be defined on its own rack through the AutoMax Programming Executive.
- Tell SIGMA which tags defined through the AutoMax Programming Executive are provided by which message and rack.

This section describes how to configure the SLC Database for SIGMA-CN Communication. Topics for discussion include:

- Using the Port Configuration Screen to Define Messages
- Entering Port Configuration Parameters for a ControlNet Message
- Using the Port Configuration ***Description*** Field
- Configuring Multiple Messages
- Multiple ControlNet Message and Card Issues
- Other SST Configuration and Setup Issues
- Creating the ControlNet Configuration File

4.2 Using the Port Configuration Screen to Define Messages

The SLC Database Editor's ***Port Configuration*** screen (Figure 4-1) is used to define the ControlNet messaging parameters for each message SIGMA is to produce or consume. This screen is where you would typically configure each of the PC Link cards the SIGMA uses to communicate with AutoMax. Both kinds of configurations can be specified through the ***Port Configuration*** screen.

The key to creating the correct ControlNet message configuration is to remember that you must create a Port Configuration entry for every message that SIGMA is to produce or consume. To create a new Port Configuration entry, select ***Append*** from the ***Edit*** menu. This creates a new, blank Port Configuration entry, and you can then enter the necessary parameters.

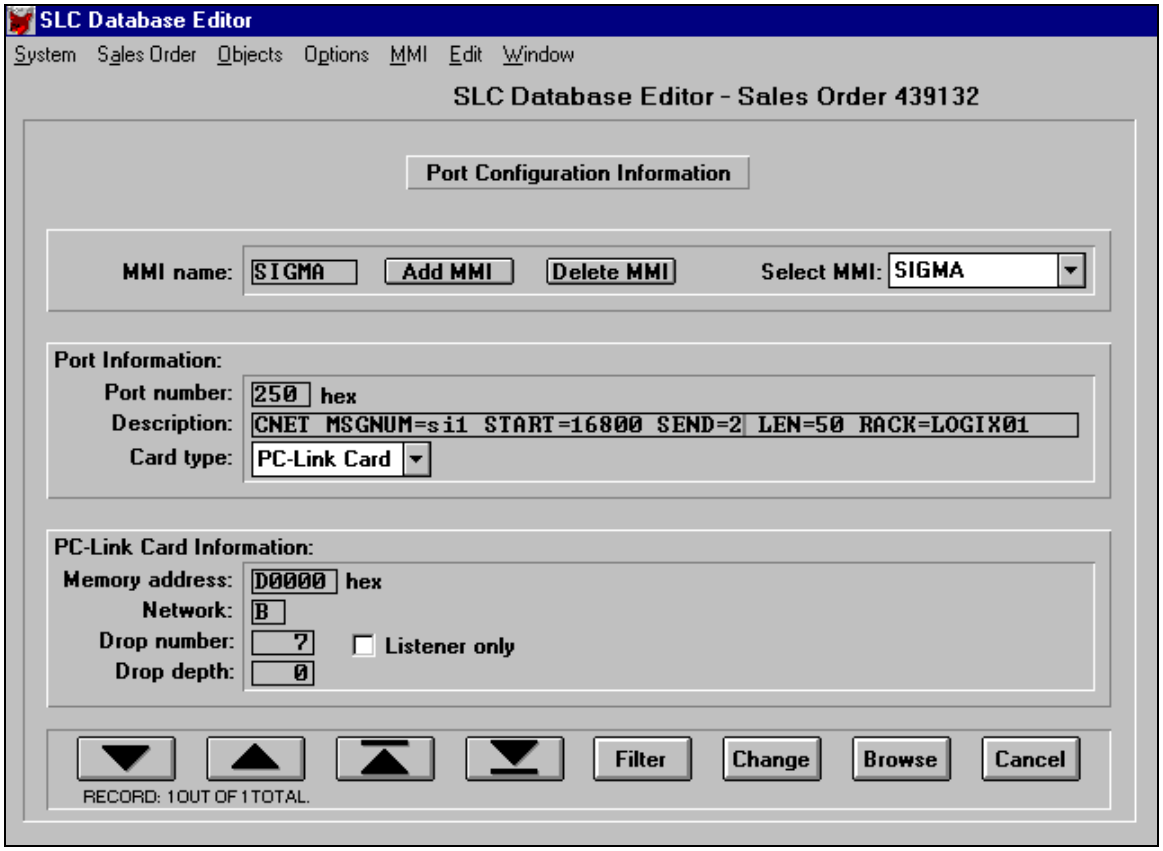

Figure 4-1 SLC Database Editor and Port Configuration Screen

4.2.1 Entering Port Configuration Parameters for a ControlNet Message

Refer to Figure 4-1. After you have created a new Port Configuration entry, you must enter the appropriate parameters for the ControlNet message being configured. The most important parameter is the ***Description*** field. This contains specific ControlNet messaging information in a fixed format.

CAUTION	**If the format of the *Description* field described below is not followed exactly, or if any of the other configuration parameters are not specified exactly, SIGMA will not be able to produce or consume the message.**

Each field on the ***Port Configuration*** screen is described below, with the ***Description*** field being described last. You must be very careful to follow all of the parameter entry rules. Additional rules are provided in subsequent sections, which also must be followed.

MMI Name – name of the SIGMA computer to which this configuration applies; only matters if you are configuring a system with multiple SIGMAs connected to ControlNet having different messaging configurations. More information on multiple SIGMA computers can be found in section *4.3 Multiple ControlNet Message and Card Issues*.

Port number – The computer's port where the CN-ISA card responsible for the message is loaded. This is specified in hexadecimal, and is typically 250, 258, or 260. This must match the port number value specified in the driver loading statement in the CONFIG.SYS file, and the dipswitch settings on the CN-ISA card. A value should only be specified for the first port entry defined for the CN-ISA card. Otherwise, this field must be blank.

Card type – Always set to PC Link card. This is done by default.

Memory address – Address in the computer's memory where the CN-ISA card's dual port memory is loaded. This is a hexadecimal value and must match the memory location specified in the driver loading statement in the CONFIG.SYS file.

Note:	You must specify five digits rather than four as in the CONFIG.SYS file. The fifth digit is always 0. (e.g., if the memory address value in the CONFIG.SYS file is D000 then you must enter D0000 as the value for this parameter)

Network – Must be a unique alphabetic character to indicate all messages being produced or consumed on a ControlNet network segment. (e.g., if PC Link cards are using A, B, and C, then use D here for all Port Configuration records describing the messages on a given ControlNet segment. If messages are coming from another ControlNet segment through a CNB module, then use E for those messages.)

Drop number – ControlNet node number (MAC ID) of the CN-ISA card in the SIGMA. This is defined externally through the SST ControlNet Configuration Utility, or RSNetworx 3.00.00.12 or later, and the value here must match that assignment.

Drop depth – Not used for ControlNet message configuration (must be **0**).

Listener only – This field must be unchecked for ControlNet message configuration.

4.2.2 Using the Description Field

The ***Description*** field specifies various parameters of a ControlNet message using a fixed format of parameter names and values. You are responsible for correctly specifying the required parameters and values. There is no validation of this field before the SIGMA system is restarted. If the format of this field is incorrect, or if the values specified are incorrect, then SIGMA will not be able to process the message. The ***Description*** field must have the following format (Figure 4-1):

CNET MSGNUM={val} START={val} SEND={val} LEN={val} RACK={val}

Each parameter except the first (***CNET***) requires a value to be specified. The parameters have the following meaning:

CNET
Indicates that this Port Configuration entry is describing a ControlNet message.

MSGNUM
Specifies the ControlNet message number for the message.

In the case of SIGMA consuming data from ControlLogix through a CNB module, this is the tag name associated with the UDT that produces the message data. The tag name is specified through RSLogix5000 in the ***Controller Tags*** section.

In the case of SIGMA producing data for either ControlLogix or MBCN this value must be set to ***255***.

In the case of SIGMA consuming data from the MBCN, this is the ***Consume Buffer ID*** value specified through the SST ControlNet Configuration Utility for the CN-ISA card.

START
The register number of the tag that is the first data tag in the message. This register number is assigned through the AutoMax Programming Executive and can be found by examining the appropriate tag in the ***Variables*** screen under the ***Objects*** menu of the SLC Database Editor.

LEN
Length of the message in 16-bit words. Do not include control status registers in this length.

In the case of SIGMA producing or consuming data from ControlLogix through a CNB module, this corresponds to the ***Size*** of the UDT representing the message in the ***User-Defined Type*** section of RSLogix5000. Remember that this value is always specified in 16-bit words, so if you are producing a DINT array, you must multiply the array size by two to get the proper value for this parameter.

In the case of SIGMA consuming data from the MBCN, this corresponds to the ***Size*** specified in the SST ControlNet Configuration Utility ***Node Properties*** page's ***General*** tab for the MBCN producer item.

RACK
The name of the AutoMax rack containing the configuration of the tags making up this message. This is defined through the AutoMax Programming Executive, and can also be viewed through the ***Add/Remove Racks*** screen under the ***Sales Order*** menu, or the

Variables screen for a tag within the message under the ***Objects*** menu in the SLC Database Editor.

4.2.3 Configuring Multiple Messages

Since it is possible that a given ControlNet node may produce more than one message for SIGMA, you must properly configure as many Port Configuration entries as there are messages. When you configure the first message for the node, use the rules described in the previous section. When you configure the subsequent messages for the node, use the following rules:

- Define the ***Description*** field as described previously. Ensure that you specify the correct ***MSGNUM***, ***START***, ***SEND***, and ***LEN*** parameters.
- Only specify a value in the ***Port Number*** field for the first Port Configuration entry you create. Do not specify a value in this field for any other Port Configuration entries.

4.3 Multiple ControlNet Message and Card Issues

There is a 250-register limit on message length. If you are sending more data to SIGMA, you must define additional messages.

If setting up multiple CN-ISA Cards, use the SST Configuration Tool to set up a scanner for each card. This is saved as multiple configuration files, one for each card. Each file should be named by ***Port Number***. The AUTOEXEC.BAT downloads the card configuration, based on ***Port Number*** on SIGMA startup. C:\SIGMA\CONFIG\CNETnnn.BSS.

> **Note:** The CN-ISA Card configuration file must be downloaded to the SIGMA Server from the RSLogix Development Station (on a floppy disk, or by an FTP link).

4.4 Other SST Configuration and Setup Issues

When talking to ControlLogix or other scheduled data producer, you must still run RSNetworx for the ControlNet, which provides finalized schedule information to the devices. (This will download configuration information to SIGMA if it is a keeper, e.g., allows you to take FlexIO with scheduled data, and then use SIGMA to trend FlexIO at 50ms).

SST configuration does not need to know about all the devices on the ControlNet, only those SIGMA communicates with.

4.5 Creating the ControlNet Configuration File

Load and run the SST ControlNet Configuration Tool on your RS Logix Development Machine (Windows NT/95/98 OS). The Configuration Tool generates a configuration file for the CN-ISA Card on your SIGMA / SIGMA Server. This file tells the CN-ISA Card how to read the network. (Refer to ControlNet Configuration Tool documentation for details.)

Once the new ControlNet configuration file has been generated, copy it to your SIGMA / SIGMA Server (Figure 1-1).

- Copy the file to C:\SIGMA\CONFIG\CNETnnn.BSS

> **Note:** Any time you make a change in the ControlNet network, you must run the ControlNet Configuration Tool and edit the configuration file for your SIGMA Server's CN-ISA Card, and save it back onto the SIGMA / SIGMA Server in C:\CNET\CNET.SS1.

- Reboot the SIGMA, which reloads the ControlNet drivers, and re-reads and uses the new ControlNet configuration parameters.